What is claimed is:

1. A method for reducing a shot noise component of Angle Random Walk noise in a fiber optic sensor having an optical source providing optical power to a sensing coil through an optical fiber and a first coupler positioned between the optical source and the sensing coil to direct a sensor signal from the sensing coil to a photodetector, the method comprising providing an optical amplifier between the first coupler and the photodetector.

2. The method of claim 1, further comprising providing an isolator between the first coupler and the optical amplifier to suppress back facet emissions of the optical amplifier emitted in a direction towards the first coupler.

3. The method of claim 2, further comprising:

(a) providing a second coupler between the optical amplifier and the isolator;

(b) providing a second detector on a leg of the second coupler to receive the back facet emissions from the optical amplifier; and

(c) subtracting the back facet emissions received at the second detector from the sensor signal and front facet emissions of the optical amplifier received at the photodetector.

4. The method of claim 3, further comprising providing a polarizer immediately adjacent an input of at least one of the photodetector and the second detector, the polarizer allowing emissions in a preferred polarization to reach the at least one of the photodetector and the second detector to which the polarizer is adjacent.

5. The method of claim 1, further comprising providing a polarizer immediately adjacent an input of the photodetector to allow emissions in a preferred polarization to reach the photodetector.

6. The method of claim 1, further comprising:

(a) providing a second detector on a free leg of the first coupler to receive a source sample from the optical source;

(b) delaying the source sample to provide a delayed source sample coinciding with the sensor signal;

(c) modulating the delayed source sample to provide a modulated source sample; and

(d) subtracting the modulated source sample from the sensor signal to subtract a Relative Intensity Noise.

7. The method of claim 6, further comprising providing a polarizer immediately adjacent an input of at least one of the photodetector and the second detector, the polarizer allowing emissions in a preferred polarization to reach the at least one of the photodetector and the second detector to which the polarizer is adjacent.

8. The method of claim 6, further comprising providing an isolator between the first coupler and the optical amplifier to suppress back facet emissions of the optical amplifier emitted in a direction towards the first coupler.

9. The method of claim 8, further comprising:

(a) providing a second coupler between the optical amplifier and the isolator;

(b) providing a third detector on a first leg of the second coupler to receive the back facet emissions from the optical amplifier; and

(c) subtracting the back facet emissions received at the third detector from the sensor signal and front facet emissions of the optical amplifier received at the photodetector.

10. The method of claim 9, further comprising providing a polarizer immediately adjacent an input of at least one of the photodetector, the second detector and the third detector, the polarizer allowing emissions in a preferred polarization to reach the at least one of the photodetector, the second detector and the third detector to which the polarizer is adjacent.

11. The method of claim 1, comprising choosing the optical amplifier from one of a semiconductor optical amplifier, a rare-earth doped fiber amplifier and a traveling wave optical amplifier.

12. The method of claim 1, comprising configuring the sensor as a fiber optic current sensor.

13. The method of claim 12, comprising configuring the sensing coil as a reflective coil.

14. The method of claim 1, comprising configuring the sensor as a fiber optic gyroscope (FOG).

15. The method of claim 14, comprising configuring the FOG as one of a closed loop FOG and an open loop FOG.

16. The method of claim 1, comprising employing integrated optical circuits in optical waveguide material as components of the sensor.

17. The method of claim 16, comprising forming the optical waveguide material of lithium niobate.

18. The method of claim 16, comprising fabricating the sensing coil on a substrate material.

19. A fiber optic sensor, comprising:

(a) an optical source providing optical power to a sensing coil of the fiber optic sensor through an optical fiber;

(b) a first coupler positioned between the sensing coil and the optical source;

(c) a photodetector positioned on a leg of the first coupler to receive a sensing signal of the sensing coil; and

(d) an optical amplifier positioned between the first coupler and the photodetector.

20. The sensor of claim 19, wherein the optical source is an optical amplifier power source.

21. The sensor of claim 19, further comprising an isolator positioned between the first coupler and the optical amplifier.

22. The sensor of claim 21, further comprising:

(a) a second coupler positioned between the optical amplifier and the isolator;

(b) a second detector positioned on a leg of the second coupler to receive back facet emissions from the optical amplifier; and

(c) a subtractor to subtract the back facet emissions from the sensing signal and front facet emissions of the optical amplifier received at the photodetector.

23. The sensor of claim 22, further comprising a polarizer positioned immediately adjacent an input of at least one of the photodetector and the second detector.

24. The sensor of claim 23, wherein the optical source is an optical amplifier power source.

25. The sensor of claim 19, further comprising a polarizer positioned immediately adjacent an input of the photodetector.

26. The sensor of claim 19, further comprising:

(a) a second detector positioned on a free leg of the first coupler to receive a source sample from the optical source;

(b) a delay to provide a delayed source sample coinciding with the sensing signal;

(c) a modulator to provide a modulated delayed source sample; and

(d) a subtractor to subtract the modulated delayed source sample from the sensing signal.

27. The sensor of claim 26, further comprising a polarizer positioned immediately adjacent an input of at least one of the photodetector and the second detector.

28. The sensor of claim 26, further comprising an isolator positioned between the first coupler and the optical amplifier.

29. The sensor of claim 28, further comprising:

(a) a second coupler positioned between the optical amplifier and the isolator;

(b) a third detector positioned on a leg of the second coupler to receive back facet emissions from the optical amplifier; and

(c) a subtractor to subtract the back facet emissions from the sensing signal and front facet emissions of the optical amplifier received at the photodetector.

30. The sensor of claim 29, further comprising an additional optical amplifier positioned between at least one of the second and third detectors and their respective couplers.

31. The sensor of claim 30, further comprising an isolator positioned between the additional optical amplifier and the respective coupler.

32. The sensor of claim 29, further comprising a polarizer positioned immediately adjacent an input of at least one of the photodetector, the second detector and the third detector.

33. The sensor of claim 32, wherein the optical source is an optical amplifier power source.

34. The sensor of claim 19, wherein the optical amplifier is a semiconductor optical amplifier.

35. The sensor of claim 19, wherein the optical amplifier is a rare-earth doped fiber amplifier.

36. The sensor of claim 19, wherein the optical amplifier is a traveling wave optical amplifier.

37. The sensor of claim 19, wherein the sensor is a fiber optic current sensor.

38. The sensor of claim 37, wherein the sensing coil is a reflective coil.

39. The sensor of claim 19, wherein the sensor is a fiber optic gyroscope (FOG).

40. The sensor of claim 39, wherein the FOG is a closed loop FOG.

41. The sensor of claim 39, wherein the FOG is an open loop FOG.

42. The sensor of claim 19, wherein the sensor employs integrated optical circuits in optical waveguide material.

43. The sensor of claim 42, wherein the optical waveguide material is lithium niobate.

44 The sensor of claim 42, wherein the sensing coil is created on a substrate material.

45. A fiber optic sensor, comprising:

(a) an optical source providing optical power to the fiber optic sensor through an optical fiber;

(b) a sensor coil having a first end and a second end generating a sensing signal;

(c) a first coupler positioned between the optical source and the sensor coil;

(d) a first photodetector positioned on a free leg of the first coupler to receive a sensing signal;

(e) a linear polarizer positioned between the first coupler and the sensor coil;

(f) a second coupler positioned between the linear polarizer and the two ends of the sensor coil;

(g) a phase modulator positioned between the first end of the sensor coil and the second coupler;

(h) an optical amplifier positioned between the first coupler and the first photodetector;

(i) a second photodetector positioned on another leg of the first coupler to receive a source sample from the optical source;

(j) a delay to provide a delayed source sample coinciding with the sensing signal;

(k) a sample modulator to provide a modulated delayed source sample;

(l) a sample subtractor to subtract the modulated delayed source sample from the sensing signal;

(m) an isolator positioned between the first coupler and the optical amplifier to suppress back facet emissions of the optical amplifier emitted in a direction towards the first coupler;

(n) a third coupler positioned between the optical amplifier and the isolator;

(o) a third photodetector positioned on a leg of the third coupler to receive the back facet emissions from the optical amplifier;

(p) an emissions subtractor to subtract the back facet emissions from the sensing signal and front facet emissions of the optical amplifier received at the first photodetector; and

(q) an additional linear polarizer positioned immediately adjacent an input of at least one of the photodetectors.

46. The sensor of claim 45, wherein the optical amplifier is a semiconductor optical amplifier.

47. The sensor of claim 45, wherein the optical amplifier is a rare-earth doped fiber amplifier.

48. The sensor of claim 45, wherein the optical amplifier is a traveling wave optical amplifier.

49. The sensor of claim 45, wherein the sensor is a fiber optic current sensor.

50. The sensor of claim 49, wherein the sensing coil is a reflective coil.

51. The sensor of claim 45, wherein the sensor is a fiber optic gyroscope (FOG).

52. The sensor of claim 51, wherein the FOG is a closed loop FOG.

53. The sensor of claim 51, wherein the FOG is an open loop FOG.

54. The sensor of claim 45, wherein the sensor employs integrated optical circuits in optical waveguide material.

55. The sensor of claim 54, wherein the optical waveguide material is lithium niobate.

56. The sensor of claim 54, wherein the sensing coil is created on a substrate material.